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# **Annual Report**

**2006**

## **Kentucky Transportation Center**

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## Note from the Director

Professor Garrett Hardin views man as incapable of managing any natural resource for the benefit of society. He refers to this as "The Tragedy of the Commons" since natural resources are typically held in common amongst the people of the world (or nations). The air we breathe and the water we drink are good examples of things held in "common". If anyone of us harms these resources we harm those of our neighbors also.



In many respects, this same philosophy might be applied to our transportation infrastructure which is widespread and considered as common property amongst all its users. Transportation is essential to our lifestyle, our economy, and our society in general. Without transportation we would be lost. Our economy would deteriorate, our standard of living would be reduced and many things that we take for granted, because of transportation, would disappear or become very costly.

Each of use assumes that the transportation system will always be at our service regardless of the care (or lack thereof) that we provide to it. We expect it to survive the onslaught of more cars and trucks without a responsible action to keep it in service. Like the air we breathe and the water we drink, our transportation system is being destroyed from over use and neglect. Who must assume the responsibility for restoring this critical elements of our society which is held in "common trust"?

The tragedy is that we know the remedy for this problem. We need to invest in and manage this critical resource—today, tomorrow and into the future. If we don't then the real "Tragedy of the Commons" will be upon us all.

*Paul E. Joussaint, PE*

## Research Reports Published During FY 2005-2006 (continued)

KTC-06-21	"Site Investigation of Bridges along I-24 in Western Kentucky"
KTC-06-22	"Seismic Evaluation and Ranking of Bridges along I-24 in Western Kentucky"
KTC-06-23	"Detailed Seismic Evaluation of Bridges along I-24 in Western Kentucky"
KTC-06-24	"Seismic Evaluation of the Tennessee River Bridges on I-24 in Western Kentucky"
KTC-06-25	"Seismic Evaluation of the Cumberland River Bridges on I-24 in Western Kentucky"
KTC-06-26	"Seismic Evaluation and Ranking of Bridge Embankments along I-24 in Western Kentucky"
KTC-06-27	"2006 Safety Belt Usage Survey in Kentucky"
KTC-06-28	"Highway Noise and Land Use Compatibility"
KTC-06-29	"Analysis of Traffic Crash Data in Kentucky (2001-2005)"
KTC-06-30	"Post Earthquake Investigation Field Manual for the State of Kentucky"
KTC-06-31	"Update ESAL Forecasting Estimation Program for Superpave Design"
KTC-06-32	"Project Payout Schedules"
KTC-06-33	"Traffic Control Procedures for Emergency Responders"
KTC-06-34	"Annual Update of Data for Estimating ESAIs"
KTC-06-35	"Best Management Practices Used by KyTC for On-Site Erosion Control"

**All of KTC's Research Reports published since 2000  
are available on our web site: [www.ktc.uky.edu](http://www.ktc.uky.edu).**

### ***Research Reports Published During FY 2005-2006***

KTC-06-01	"Shear Repair of P.C. Box Beam Using Carbon Fiber Reinforced (CFRP) Fabric"
KTC-06-02	"Performance Evaluation of Concrete Bridge Decks Reinforced with MMFX and SSC Rebars"
KTC-06-03	"Reuse of Soil-Lime Mixture for Subgrade Stabilization: KY 1303 Kenton County"
KTC-06-04	"Baseline Modeling of the Owensboro Cable-Stayed Bridge of the Ohio River"
KTC-06-05	"Performance Evaluation of Bridges with Structural Bridge Deck Overlays (SBDO)"
KTC-06-06	"Field Inspection and Evaluation of a Bridge Deck Reinforced with Carbon Fiber Reinforced Polymer (CFRP) Bars"
KTC-06-07	"Value of Research: SPR 2000-2005"
KTC-06-08	"Evaluation of Work Zone Safety Operations and Issues"
KTC-06-09	"Privatizing Transportation Through Public-Private Partnerships: Definitions, Models and Issues"
KTC-06-10	"Evaluation of the Eastern Kentucky Rural Highway Information Project"
KTC-06-11	"Early State Benefit Cost Analysis for Estimating Economic Impacts"
KTC-06-12	"Analysis of Inconsistencies Related to Design Speed, Operating Speed, and Speed Limits"
KTC-06-13	"Characteristics and Engineering Properties of the Soft Soil Layer in Highway Soil Subgrades"
KTC-06-14	"Operational Analysis: Cooper Drive Pedestrian Study"
KTC-06-15	"A Needs Assessment and Technology Evaluation for Roadside Identification of Commercial Vehicles"
KTC-06-16	"Quantification of the Benefits of Access Management for Kentucky"
KTC-06-17	"Evaluation of Kentucky's 'Buckle Up Kentucky: It's the Law and It's Enforced' 2006 Campaign"
KTC-06-18	"Development of a Traffic Sign Inventory System, (Sign Click)"
KTC-06-19	"An Analysis of the Direct and Indirect Costs of Utility and Right-of-Way Conflicts on Construction Roadway Projects"
KTC-06-20	"Seismic Evaluation of Bridges and Embankments along I-24 in Western Kentucky—Summary Report"

### **Research Highlights—Traffic and Safety Section**

A recent research project developed and pilot tested a sign inventory system for use by the Kentucky Transportation Cabinet. This automated inventory process has been successfully implemented by the Cabinet in the Lexington area. Sign Click is a program that creates and maintains a highway sign database. The program allows a user to click on a point on the map and add a sign assembly and various details about the assembly. The program will automatically calculate the roadway location (in county, route and milepoint format), give GPS location, and determine the street address. The user can add, delete and edit existing sign assemblies. Visit [www.ktc.uky.edu/SignClick](http://www.ktc.uky.edu/SignClick) to see more about the software and for a free download.



## Research Highlights—ITS Section

### *The Integrated Safety and Security Enforcement System*



Three of Kentucky's weigh stations have recently been equipped with technologies to enhance the screening of commercial vehicles. The Integrated Safety and Security Enforcement System includes radiation portal monitors to detect radioactive materials, infrared imaging to detect brake deficiencies, an automated license plate reader, and an automated system to read the USDOT number from the side of the truck. The center contracted with Transportation Security Technologies, LLC (Transtec), for installation of the systems. The center will evaluate the system performance and assess how the system can be used to improve the safety and security of the surface

transportation system. Other partners in the project include the Federal Motor Carrier Safety Administration, the US Department of Homeland Security, The Kentucky Transportation Cabinet, the Kentucky Office of Homeland Security, Kentucky Vehicle Enforcement, and Oak Ridge National Laboratory.

## Financial Snapshot

### FY06 Expenditures\*

Category/ Program Area	Research**	Technology Transfer	CTI Academy	Advanced Institute	<i>Total</i>
Personnel	3,438,848	541,665	430,640	50,997	<b>4,462,151</b>
Operating	1,264,074	382,948	305,572	0	<b>1,952,594</b>
Equipment	160,041	0	0	0	<b>160,041</b>
Indirect Costs	859,500	0	124,224	0	<b>983,724</b>
<b>Total Program</b>	<b>5,722,463</b>	<b>924,614</b>	<b>869,436</b>	<b>50,997</b>	<b>7,558,510</b>

\*Expenditure detail by subcategory of expense is available on request (1-800-432-0719)

\*\* The research/study program for FY06 consisted of over 100 projects conducted for the following agencies: the Kentucky Transportation Cabinet, Kentucky State Police, USDOT/FHWA, USDOT/FMCSA, NSF, TRB/NCHRP, NOR-PASS, and various other public jurisdictions. Some work is done in cooperation with other universities including: Northwestern University, University of Louisville, University of Tennessee, and Calspan-University of Buffalo Research Center and also in partnership with firms and organizations such as HMB Professional Engineers, Wilbur Smith Associates, and the Asphalt Institute.

## Special Programs and Projects



Mandated congressional funding for community transportation innovation research and education was first received in 2003. That continued academy initiative has spawned many focused research and education projects at the University of Kentucky and the University of Louisville. Over 10 innovative research and education projects have been completed and several are currently underway. Education efforts have provided in-service training for transportation professionals, graduate students have been supported, new college-level course content has been developed, and web-based courses initiated.

The center's professional researchers and civil engineering faculty have teamed to successfully compete for national research funding over the past few years. Two such projects funded by the Transportation Research Board are currently underway. One project, nearing completion, aims to discover the safety impacts of design element trade-offs. The other that has just been initiated is developing and testing methods to quantify the benefits of "context-sensitive solutions" in transportation facilities. These grant awards recognize the expertise developed at UK in highway context sensitive design and solutions.



## Research Highlights—Pavements Section

### *Analysis of Permeability of Kentucky Hot Mix Pavements*

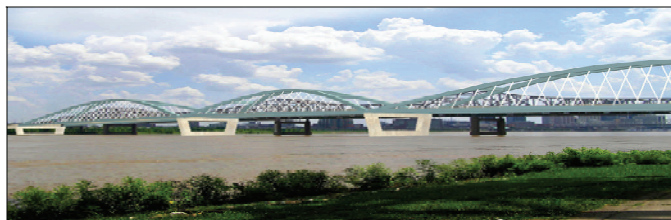
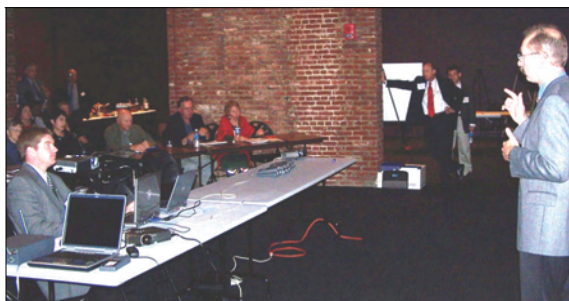
Permeability of hot-mix asphalt (HMA) pavements is an important issue in Kentucky and other states that use coarse-graded Superpave mixtures. Studies have shown that Superpave mixtures are more permeable than conventional dense-graded mixes at similar air void levels. This is because larger void sizes of the coarse-graded asphalt mixes increase the probability of interconnection between voids that facilitate water flow. It is generally expected that the life of a permeable pavement would be shorter than that of an impermeable pavement due to striping and excessive oxidation associated with the infiltration of water or air into the permeable pavement. Under a previous study an air induced permeameter was developed to measure the in-situ permeability of HMA surfaces. In addition, a trial specification for permeability was also developed. Currently the center is evaluating the trial specification on selected projects across the state. Both 0.5-inch and 0.38-inch nominal maximum aggregate size surface mixtures have been utilized, it has been determined that 0.5-inch mixtures do not provide the permeability performance expected and therefore will no longer be utilized.





## Research Highlights—Policy and Systems Analysis

Since August of 2005, the Center's planning and systems analysis group has supported 4 different consulting firms in the design of the Louisville-Southern Indiana Ohio River Bridges project. Using their Structured Public Involvement (SPI) protocol, research staff developed a method to allow hundreds of citizens to participate in the bridge type selection process for two bridges to be built across the Ohio River in and near Louisville. The four-step process has narrowed the possible designs down from 31 to 3 for each of two locations. Public satisfaction with the process has been high, and the consulting firms have gained useful and detailed information about which design properties yielded higher visual preferences and which were less strongly preferred. The success of this approach has led to the SPI team being asked to assist in a new bridge project in Western Kentucky.



## Research Highlights—Structures and Coatings Section

### *Recycling Practices for Environmental Materials*

KyTC is seeking to implement improved practices for handling/disposing of organic materials in an environmentally acceptable manner. Other state highway agencies are employing recycling to address disposal of tree and brush debris. Another practice that has been used by other state highway agencies is the decomposition of large road kill carcasses such as deer in lieu of burial. The objective of this study is to closely study the related practices of other state highway agencies (SHAs) in composting/recycling large animal road-kill carcasses and determine which practices can be adopted by KyTC.



## Research Highlights—Geotechnology Section



### *Reduction of Stresses on Buried Rigid Highway Structures*

#### *Using the Ditch Method and Geofoam*

Reinforced concrete box culverts are frequently used to convey water beneath highway embankments. These costly structures are needed to withstand large vertical earth pressures created by embankment loading. The aim of this study was to examine a technique to reduce vertical stresses acting on the culvert by constructing a trench located directly above the culvert and backfilling with geofoam blocks.

Numerical analyses showed that the vertical stresses could be reduced approximately 80 percent. To verify the results of the analyses, instrumentation including earth pressure cells, strain gages, and inverted settlement platforms, were placed on and in the culvert. Measurements indicated vertical stresses were reduced by 90 percent. By reducing vertical stresses, culvert sizes can potentially be reduced to create savings. The technique may be very applicable to roadway widening projects where additional fill and pressures are created and act on existing culverts. This technique could save removal/rebuilding of some older culverts.



## Research Highlights—Construction Management Section



### *An Analysis of the Direct and Indirect Costs of Utility and Right-of-Way Conflicts on Construction Roadway Projects*

The research report (KYSPR-05-293) was released following completion of a two-year study that examined the sources and the direct and indirect costs of utility and right-of-way conflicts on construction road way projects. Traditionally, the costs of utility conflicts has gone unmeasured. Phase one of the study involved five case studies of previous roadway projects and quantified both the direct and indirect costs of the utility conflicts on these projects. The costs due to the utility conflicts as a percentage of the total construction costs ranged from 1.3% to 4.8%. While the case studies provided many valuable lessons learned, they also clearly showed that efforts to reduce the frequency and severity of utility conflicts are warranted. In addition to the case studies, the research conducted a nationwide survey involving 45 state utility directors to examine the frequency and severity of the different types of utility conflicts within their states and best practices that are used to avoid them. Finally, with the support of the research's study advisory committee, the research developed a comprehensive roadmap for the Cabinet to follow in order to help avoid utility and right-of-way conflicts on future roadway projects. The roadmap addresses short term (less than 5 years), medium term (5 to 10 years) and long term (more than 10 years) actions to be taken by the Cabinet to help avoid future utility and right-of-way conflicts.



## Technology Transfer

The Technology Transfer Program is all about sharing transportation knowledge, improving skills, and putting research and new technologies into practice. Whether you are a motor grader operator, a traffic engineer, or a pavement technologist working for a highway contracting agency, Kentucky's T<sup>2</sup> Program has opportunities for professional development.



Opportunities include a safety circuit rider program, a transportation library, publications, Roads Scholar and Road Master Programs, and special interest training designed to solve specific problems.

The Transportation Library continuously updates its materials. As a result of aggressive marketing, the library has seen a 14 percent increase in the number of videos distributed to agencies. Many of these are in remote locations and use the materials to create their own training programs. By involving patrons in video evaluations, staff are able to closely target specific needs. Total number of materials distributed to patrons statewide was 3,454.

The Safety Circuit Rider Program is a major resource for improving safety on low-volume rural roads. Over half the state's counties have benefited from this hands-on, in-the-field technical assistance program resulting in a 26 percent reduction of crashes on target roadways. The Safety Circuit Rider Program includes classroom training, safety audits, and applied problem-solving techniques that lead to more skilled maintenance workers who can continue to apply these techniques to local roads. During the past fiscal year, 193 individuals have participated in the Low-Cost Roadway Safety Improvements Workshop, which is part of the Safety Circuit Rider Program. Other projects to keep our roadways safe included:

- The second annual Kentucky Lifesavers Conference was held in Louisville. This conference brings together representatives of Engineering, Enforcement, Education and Emergency Services to address coordinated efforts for improving safety. The conference, attended by 393 people, addressed topics such as Teen Driving, Red Light Running, Safe Intersections, Child Passenger Safety, Driver Fatigue and Improving and Using Highway Crash Statistics.
- Through a partnership with the Kentucky Chapter, APWA, advanced levels of training in Work Zone Traffic Control were presented.

The T<sup>2</sup> Training Program continues to be the primary method for technology transfer and during FY 05-06 conducted 156 workshops for 5,500 participants, an increase in participation of 24 percent over the previous year. There was an increase of 45 percent in the number of individuals using the online registration process. The increased use of online registrations, along with the 10 percent increase in the number of hits on our website, demonstrated the increased use of computers by our customers. This led to two successful distance learning projects:

- The Van Driver Training Program qualifies individuals to drive state-owned 15-passenger vans. This online training program qualified 1,454 individuals during FY 05-06.
- A video conference on Maintenance of Low-Volume Roads was downlinked to fourteen sites and attended by 85 governmental maintenance workers.

The LINK newsletter, along with a yearly training calendar and our website, continues to be our primary contact to all transportation workers in Kentucky. The newsletter is issued quarterly and covers transportation innovations of importance to rural Kentucky, along with updated training and library information.

The Kentucky Technology Transfer Program has served as a Local Technical Assistance Program since 1984 and continues to be viewed as a national leader in service to local agencies. Technology Transfer staff help guide the national programs through service on policy-making boards and committees and works to strengthen partnerships with public and private organizations in order to promote safe and effective transportation systems.

